

CLAIM AMENDMENTS

Claims 1 - 10. (Cancelled).

11. (Previously presented) A quantum tunneling device formed in accordance with a method comprising the steps of:

providing a quantum well, said quantum well comprising a composite material, said composite material comprising at least a first and a second material; and processing said quantum well so as to form at least one segregated quantum tunneling structure encased within a shell comprised of a material arising from processing said composite material, wherein each said segregated quantum structure is substantially comprised of said first material.

Claims 12 – 19 (Cancelled).

20. (Previously presented) A quantum tunneling device formed in accordance with a method comprising the steps of:

providing a quantum well, said quantum well comprising at least three layers, each of said at least three layers comprising a first material, wherein at least one of said at least three layers additionally comprises at least a second material; and processing said quantum well so as to form at least one segregated quantum structure comprising at least said second material encased in a material arising from processing said first material.

Claims 21 – 38 (Cancelled).

39. (Previously presented) A quantum tunneling device formed in accordance with a method comprising the steps of:

- growing a quantum well on a substrate, said quantum well comprising at least a first material and a second material;
- patterning a mask on said quantum well;
- etching said quantum well so as to form a pillar; and
- processing said pillar so as to convert said first material thereby forming an altered first material and causing said second material to form at least one segregated quantum structure embedded in said altered first material.

40. (Original) A quantum tunneling device comprising:

- at least one segregated quantum structure; and
- a casing of a first material encapsulating said at least one segregated quantum structure, wherein said casing is sufficiently thin so as to permit quantum tunneling of electrons from a first segregated quantum structure to a structure selected from the group consisting of segregated quantum structures and electrodes.

41. (Original) The quantum tunneling device according to claim 40 wherein said at least one segregated quantum structure has a diameter of less than about 200 nanometers.

42. (Original) The quantum tunneling device according to claim 40 wherein said at least one segregated quantum tunneling structure has a diameter of less than about 50 nanometers.

43. (Original) The quantum tunneling device according to claim 40 wherein said segregated quantum structure comprises a material selected from the group consisting of silicon, germanium, carbon, tin, gallium, arsenic, indium, aluminum, phosphorus, boron, antimony, nitrogen, zinc, sulfur, selenium, tellurium, cadmium, mercury, lead, and mixtures thereof.

44. (Original) The quantum tunneling device according to claim 40 wherein said first material comprises a material selected from the group consisting of silicon, germanium, carbon, tin, gallium, arsenic, indium, aluminum, phosphorus, antimony, nitrogen, zinc, sulfur, selenium, tellurium, cadmium, mercury, and mixtures thereof.

45. (Original) The quantum tunneling device according to claim 40 wherein said first material has been altered by a process selected from the group consisting of oxidation, reduction, and nitridation.

46. (Original) The quantum tunneling device according to claim 40 wherein said first material comprises a semi-conductive material selected from the group consisting of elements of group IIA of the periodic table, elements of group IIIA of the periodic table,

elements of group IVA of the periodic table, elements of group VA of the periodic table, elements of group VIA of the periodic table, and mixtures thereof.

47. (Original) The quantum tunneling device according to claim 40 wherein said quantum tunneling device has no dimension greater than 500 nanometers.

48. (Original) The quantum tunneling device according to claim 40 wherein said casing is substantially non-crystalline.

49. (Original) The quantum tunneling device according to claim 40 wherein said at least one segregated quantum structure is substantially crystalline.

50. (Withdrawn) The quantum tunneling device according to claim 40 having at least two segregated quantum structures, wherein said at least two segregated quantum structures are substantially aligned along an axis so as to form a segregated quantum tunneling wire.

51. (Original) An electronic device comprising:

a quantum tunneling device, said quantum tunneling device comprising at least one segregated quantum structure and a casing of a first material encapsulating said at least one segregated quantum structure; and

at least one electrode, wherein said casing is sufficiently thin so as to permit quantum tunneling of electrons from a segregated quantum structure to said at least one said electrode.

52. (Original) The electronic device according to claim 51 wherein each said segregated quantum structure has a diameter less than about 200 nanometers.

53. (Original) The electronic device according to claim 51 wherein each said segregated quantum structure has a diameter less than about 100 nanometers.

54. (Original) The electronic device according to claim 51 wherein each said segregated quantum structure has a diameter not exceeding about 25 nanometers.

55. (Original) The electronic device according to claim 51 wherein said segregated quantum structure comprises a material selected from the group consisting of silicon, germanium, carbon, tin, gallium, arsenic, indium, aluminum, phosphorus, boron, antimony, nitrogen, zinc, sulfur, selenium, tellurium, cadmium, mercury, lead, and mixtures thereof.

56. (Original) The electronic device according to claim 51 wherein said first material comprises a material selected from the group consisting of silicon, germanium, carbon, tin, gallium, arsenic, indium, aluminum, phosphorus, boron, antimony, nitrogen, zinc, sulfur, selenium, tellurium, cadmium, mercury, lead, and mixtures thereof.

57. (Original) The electronic device according to claim 51 wherein said first material comprises a semi-conductive material selected from the group consisting of elements of group IIA of the periodic table, elements of group IIIA of the periodic table, elements of group IVA of the periodic table, elements of group VA of the periodic table, elements of group VIA of the periodic table, and mixtures thereof.

58. (Original) The electronic device according to claim 51 wherein said first material has been altered by a process selected from the group consisting of oxidation, reduction, and nitradation.

59. (Original) The electronic device according to claim 51 wherein said at least one electrode comprises a material selected from the group consisting of lithium, beryllium, boron, carbon, nitrogen, oxygen, aluminum, silicon, calcium, titanium, vanadium, manganese, iron, cobalt, nickel, copper, zinc, gallium, germanium, arsenic, yttrium, zirconium, niobium, molybdenum, palladium, silver, cadmium, indium, tin, antimony, barium, tantalum, tungsten, iridium, platinum, gold, mercury, thallium, lead, bismuth, and mixtures thereof.

60. (Original) The electronic device according to claim 51 wherein said segregated quantum structure is substantially crystalline.

61. (Original) The electronic device according to claim 51 wherein said casing is substantially non-crystalline.

62. (Original) The electronic device according to claim 51 wherein said electronic device is operational at temperatures in excess of about 1K.

63. (Original) The electronic device according to claim 51, wherein said electronic device is operational at temperatures in excess of about 200K.

64. (Withdrawn) The electronic device according to claim 51, comprising at least two segregated quantum structures, wherein each said segregated quantum structure is encapsulated in said casing of said first material and wherein each said segregated quantum structure is separated from each other segregated quantum structure by a sufficiently thin layer of said first material so as to permit quantum tunneling of electrons from a given segregated quantum structure to at least one other segregated quantum structure.

65. (Withdrawn) The electronic device according to claim 64, wherein said at least two segregated quantum structures are substantially aligned along an axis so as to form a segregated quantum tunneling wire.

66. (Withdrawn) A quantum-dot cellular automata node switch comprising:

at least two quantum tunneling devices, each said quantum tunneling device comprising at least one segregated quantum structure and a casing of a first material encapsulating said segregated quantum structure, wherein each said quantum tunneling device is adjacent to at least one other said quantum tunneling device such that at least one said segregated quantum structure in a first quantum tunneling device is separated by a distance from at least one said segregated quantum structure in a second quantum tunneling device, and wherein said distance is sufficiently small so as to permit coulombic interaction between electrons from at least one said segregated quantum structure in said first quantum tunneling device and at least one said segregated quantum structure in said second quantum tunneling device; and at least two electrodes, each said electrode separated from a said segregated quantum structure by a distance, wherein said distance is sufficiently small so as to permit coulombic interaction between electrons of said segregated quantum tunneling structure and said electrode.

67. (Withdrawn) The quantum-dot cellular automata node switch according to claim 66 wherein each said segregated quantum structure has a diameter less than about 200 nanometers.

68. (Withdrawn) The quantum-dot cellular automata node switch according to claim 66 wherein each said segregated quantum structure has a diameter less than about 50 nanometers.

69. (Withdrawn) The quantum-dot cellular automata node switch according to claim 66 wherein each said segregated quantum structure has a diameter not exceeding about 10 nanometers.

70. (Withdrawn) The quantum-dot cellular automata node switch according to claim 66 wherein said segregated quantum structure comprises a material selected from the group consisting of silicon, germanium, carbon, tin, gallium, arsenic, indium, aluminum, phosphorus, boron, antimony, nitrogen, zinc, sulfur, selenium, tellurium, cadmium, mercury, lead, and mixtures thereof.

71. (Withdrawn) The quantum-dot cellular automata node switch according to claim 66 wherein said first material comprises a material selected from the group consisting of silicon, germanium, carbon, tin, gallium, arsenic, indium, phosphorus, boron, antimony, aluminum, nitrogen, zinc, sulfur, selenium, tellurium, cadmium, mercury, lead, and mixtures thereof.

72. (Withdrawn) The quantum-dot cellular automata node switch according to claim 66 wherein said first material comprises a semi-conductive material selected from the group consisting of elements of group IIA of the periodic table, elements of group IIIA of the periodic table, elements of group IVA of the periodic table, elements of group VA of the periodic table, elements of group VIA of the periodic table, and mixtures thereof.

73. (Withdrawn) The quantum-dot cellular automata node switch according to claim 66 wherein said first material has been altered by a process selected from the group consisting of oxidation, reduction, and nitradation.

74. (Withdrawn) The quantum-dot cellular automata node switch according to claim 66 wherein each said at least one electrode comprises a material selected from the group consisting of lithium, beryllium, boron, carbon, nitrogen, oxygen, aluminum, silicon, calcium, titanium, vanadium, manganese, iron, cobalt, nickel, copper, zinc, gallium, germanium, arsenic, yttrium, zirconium, niobium, molybdenum, palladium, silver, cadmium, indium, tin, antimony, barium, tantalum, tungsten, iridium, platinum, gold, mercury, thallium, lead, bismuth, and mixtures thereof.

75. (Withdrawn) The quantum-dot cellular automata node switch according to claim 66 wherein at least one of said at least two segregated quantum structures is substantially crystalline.

76. (Withdrawn) The quantum-dot cellular automata node switch according to claim 66 wherein said casing is substantially non-crystalline.

77. (Withdrawn) The quantum-dot cellular automata node switch according to claim 66 wherein said quantum-dot cellular automata node switch is operational at temperatures in excess of about 2K.

78. (Withdrawn) The quantum-dot cellular automata node switch according to claim 66 wherein said quantum-dot cellular automata node switch is operational at temperatures in excess of about 200K.

79. (Withdrawn) A quantum-dot cellular automata node switch comprising:

a quantum tunneling device, said quantum tunneling device comprising a casing of a first material and at least two segregated quantum structures, wherein each said segregated quantum structure is encapsulated in said casing of said first material, and wherein each said segregated quantum structure is separated from each other segregated quantum structure by a sufficiently thin layer of said first material so as to permit coulombic interaction between electrons from a first segregated quantum structure to a second segregated quantum structure; and at least two electrodes, each said electrode separated from a respective segregated quantum structure by said casing, said casing being sufficiently thin so as to permit coulombic interaction between electrons from said electrode to said respective segregated quantum structure.

80. (Withdrawn) The quantum-dot cellular automata node switch according to claim 79 wherein each said segregated quantum structure has a diameter less than about 200 nanometers.

81. (Withdrawn) The quantum-dot cellular automata node switch according to claim 79 wherein each said segregated quantum structure has a diameter less than about 100 nanometers.

82. (Withdrawn) The quantum-dot cellular automata node switch according to claim 79 wherein each said segregated quantum structure has a diameter less than about 20 nanometers.

83. (Withdrawn) The quantum-dot cellular automata node switch according to claim 79 wherein said segregated quantum structure comprises a material selected from the group consisting of silicon, germanium, carbon, tin, gallium, arsenic, indium, aluminum, boron, phosphorus, antimony, nitrogen, zinc, sulfur, selenium, tellurium, cadmium, mercury, lead, and mixtures thereof.

84. (Withdrawn) The quantum-dot cellular automata node switch according to claim 79 wherein said first material comprises a material selected from the group consisting of silicon, germanium, carbon, tin, gallium, arsenic, indium, aluminum, phosphorus, antimony, nitrogen, zinc, sulfur, selenium, tellurium, cadmium, mercury, boron, lead, and mixtures thereof.

85. (Withdrawn) The quantum-dot cellular automata node switch according to claim 79 wherein said first material comprises a semi-conductive material selected from the group consisting of elements of group IIA of the periodic table, elements of group IIIA of

the periodic table, elements of group IVA of the periodic table, elements of group VA of the periodic table, elements of group VIA of the periodic table, and mixtures thereof.

86. (Withdrawn) The quantum-dot cellular automata node switch according to claim 79 wherein said first material has been altered by a process selected from the group consisting of oxidation, reduction, and nitradation.

87. (Withdrawn) The quantum-dot cellular automata node switch according to claim 79 wherein each said at least two electrodes are constructed from a material selected from the group consisting of lithium, beryllium, boron, carbon, nitrogen, oxygen, aluminum, silicon, calcium, titanium, vanadium, manganese, iron, cobalt, nickel, copper, zinc, gallium, germanium, arsenic, yttrium, zirconium, niobium, molybdenum, palladium, silver, cadmium, indium, tin, antimony, barium, tantalum, tungsten, iridium, platinum, gold, mercury, thallium, lead, bismuth, and mixtures thereof.

88. (Withdrawn) The quantum-dot cellular automata node switch according to claim 79 wherein at least one of said at least two segregated quantum structures is substantially crystalline.

89. (Withdrawn) The quantum-dot cellular automata node switch according to claim 79 wherein said casing is substantially non-crystalline.

90. (Withdrawn) The quantum-dot cellular automata node switch according to claim 79 wherein said quantum-dot cellular automata node switch is operational at temperatures in excess of about 2K.

91. (Withdrawn) The quantum-dot cellular automata node switch according to claim 79 wherein said quantum-dot cellular automata node switch is operational at temperatures in excess of about 50K.